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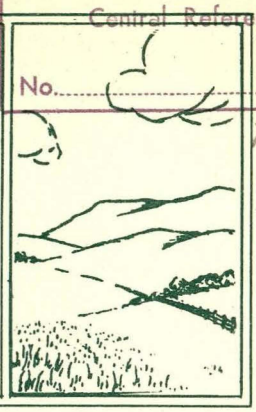

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SLASH DISPOSAL AND SITE PREPARATION IN CONVERTING OLD-GROWTH SUGAR PINE-FIR FORESTS TO REGULATED STANDS[1/]

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Records of permanent sample plots[2/] and extensive observations by forest management research workers indicate that tree selection methods of cutting in sugar pine-fir types[3/] have not favored the establishment of sugar pine reproduction. Since sugar pine is a highly prized lumber-producing species in the California region, special measures to preserve or increase its place in the stand were made part of an experimental logging project on the Stanislaus Experimental Forest in 1948 and 1949. This project was a combination field test and demonstration of unit area control, a silvicultural system for keeping the ground stocked with trees and producing at full capacity.[4/] This paper describes the slash-disposal and site-preparation measures which are essential steps in establishing regeneration on chosen unit areas within the forest.

1/ This project was under the direction of Duncan Dunning, former Chief of the Division of Forest Management Research, and William E. Hallin, in charge of Silvicultural Investigations.

2/ Fowells, H. A., and G. H. Schubert. 1951. Natural reproduction in certain cutover pine-fir stands of California. Jour. Forestry 49(3): 192-196.

3/ Sugar pine-fir type refers to mixed stands of sugar pine, Pinus lambertiana Dougl.; white fir, Abies concolor (Gord. and Glend.) Hoopes; and California red fir, Abies magnifica A. Murr.

4/ Hallin, William E. 1951. Unit area control in California forests. California Forest and Range Experiment Station. Forest Research Note No. 77. 8 p. Berkeley, Calif.

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Study Area and Objectives

The timber stands of the study area, situated about 30 miles east of Sonora, are typical of the high site-quality sugar pine-fir type of the western slopes of the Sierra Nevada. Elevation of the study area is from 6,000 to 6,500 feet, near the upper elevational limit of sugar pine in central California. The terrain is characterized by gentle to steep slopes, scattered benches, small feeder streams, and rocky ridges. Except for the tops and upper slopes of rocky ridges, all the land is Site A-200 or Site I-175 (Region 5, Forest Service, site classes based on the height-age relation of dominant trees).

The merchantable volume (stand over 11.6 inches d.b.h.) was approximately 44 percent sugar pine, 39 percent white and red fir, 13 percent California incense-cedar (Libocedrus decurrens Endl.), and 4 percent Jeffrey pine (Pinus jeffreyi Grev. and Balf.). The main brush species present were manzanita (Arctostaphylos patula Greene), whitethorn or snowbrush (Ceanothus cordulatus Kell.), deerbrush (Ceanothus integerrimus Hack and Arn.), and chinquapin (Castanopsis sempervirens Dudley).

Of the 200 acres logged, 58 acres or approximately 30 percent, were treated as regeneration areas. These unit areas, where silvicultural treatments were aimed at securing sugar pine reproduction, varied in size from one-fifth to 3 acres. Some were clear-cut with seed trees left around the border for natural reproduction. The others were clear-cut for seeding and planting. The cut on these unit areas was 88,000 board feet[5/] per acre, resulting in large accumulations of slash. Slash disposal and site preparation were done on the regeneration areas.

On the unit areas cut by other methods (group release and improvement) the original stand was 75,000 board feet per acre, of which 29,000 feet were cut. The resultant slash was not too great a fire hazard because the bare regeneration areas and skid trails served as effective firebreaks. Consequently the slash was not piled.

The objectives of slash disposal and site preparation were threefold:

1. To clear logging debris, brush, and unwanted trees from regeneration areas to facilitate seeding and planting.

2. To disturb the ground and expose mineral soil, thus providing a seedbed for sugar pine.

3. To reduce the fire hazard due to large accumulations of slash.

5/ Stand above 11.6 inches d.b.h. gross volume Scribner Decimal C Log Rule.

After the logs were yarded from a regeneration area, the slash was piled and the mineral soil exposed in one operation. Plot data[6] indicate that given an even start sugar pine can compete successfully with both fir and brush. But if establishment of the pine is delayed, brush will invade the ground cleared by cutting and will prevent subsequent establishment of pine unless costly eradication of brush is carried out. Eradicating well-established, vigorously growing brush is much more difficult than eradicating the less-vigorous brush occupying only part of the area immediately after logging. Thus the timing of this operation was important. The site had to be prepared by September on areas that were to be regenerated naturally after seedfall. On artificial-regeneration areas the site had to be readied and planted as soon after logging as possible so that brush or inferior tree species would not take control of the area. Also, to reduce the fire hazard and to put all the land back into a productive state, the slash piles had to be burned as soon as possible.

Equipment and Technique

In 1948, two tractors, one of 80 hp. and one of 130 hp., with cable-controlled angledozer blades were used at different times to pile slash. In 1949 only the 80 hp. tractor was used. A 43 hp. tractor was tried, using a cable-controlled angledozer equipped with brush-piling teeth designed by Region 6, U. S. Forest Service. These teeth were constructed so the dozer blade could be floated, that is, freed from cable support, part of the time a load was being pushed. Thus most of the disturbed soil could pass between the teeth and not be picked up in the load of slash. In practice, however, many root crowns of brush and saplings also passed between the teeth, so the brush eradication was not as effective as desired. Also, the 43 hp. tractor proved too small and unstable for the task, and it was soon abandoned in favor of the 80 hp. tractor.

The most satisfactory working team consisted of a job supervisor, a cat skinner, and swamper. The supervisor examined regeneration areas before work began on them and organized the work plan by:

1. Establishing the best boundaries of the area to be cleared for regeneration;

2. Establishing locations for piles or windrows of slash; and

3. Marking good patches of sugar pine seedlings or saplings that were to be saved. Instructions were given to the cat skinner and swamper in considerable detail. After the crew was trained the supervisor spent only an average of 2 hours a day laying out the areas and inspecting them as clearing was completed.

6/ Fowells, H. A. 1944. Site preparation as an aid to sugar pine regeneration. California Forest and Range Experiment Station. Forest Research Note No. 41. 5 p. Berkeley, Calif.

The cat skinner and swamper were normally part of the yarding crew in 1949. Their yarding assignment was to ground-skid logs from patches of reproduction and bunch the logs in openings so that a tractor and arch unit would not have to be operated in the reproduction.[7/] The clearing operation was balanced with the yarding work so one crew could do both jobs satisfactorily. Using a two-man crew for the clearing operation alone, as was done in 1948, proved inefficient for this 55,000- to 60,000-board feet per day logging operation.

Clearing was begun as soon as a few adjoining regeneration areas were logged, and was completed before the time of seedfall in 1948. In 1949 the sugar pine seed crop failed, so clearing was completed by the end of the logging season to make the area ready for seeding and planting.

Besides the slash created by an average cut of 88,000 board feet per acre, the cull logs, windfalls, high brush, litter, and scattered reproduction were moved into the piles in 1948. Chokers were set on some cull logs and other material to help move them to the piles. The dozer blade was run over the regeneration area so that the mineral soil was everywhere exposed as a seedbed.

Since the sugar pine seed crop failed in 1949, the clearing that year was designed merely to facilitate planting and to reduce the fire hazard. Some large windfalls and cull logs were left unpiled. Moving them required much time and power, and it was obvious that most sizes encountered would not interfere with the 6- by 6-foot spacing of seedlings. No special attempt was made to expose the mineral soil; yet in the process of rooting out brush and piling slash, the bulldozer exposed the soil on nearly all of the area. As a result the site was considered sufficiently prepared to act as a seedbed for natural regeneration the second year, too.

Slash piles were located on stump concentrations whenever possible. On some of the larger regeneration areas having steep slopes, slash was piled in windrows along contours. Some unburned slash and a terrace of soil remained in the windrows after the burn and served to check erosion. All slash piles and windrows were located so as to eliminate the possibility of scorching reserve timber when the slash was burned. All piles in the cleared area were kept as compact as possible so that they would burn clean and occupy a minimum of ground space. Experience with piling and burning in 1948 indicated that the tractor operator should make an effort to keep as much dirt as possible out of the piles. Soil mixed with organic material creates poor burning conditions and may cause some piles to smoulder longer than is desirable. Pushing slash uphill should be avoided as much as possible.

7/ Cosens, Richard D. 1952. Reducing logging damage. California Forest and Range Experiment Station. Forest Research Note No. 82. Berkeley, Calif.

Small groups of sugar pine seedlings and saplings were occasionally found in regeneration areas before clearing. When the trees had a spacing of approximately 6 by 6 feet or closer (roughly 1000 per acre), they were saved. Other species were cut if present, the trash was thrown out of the sugar pine group, and the tractor was kept out. On the other hand, no special attempt was made to save scattered young trees not meeting the spacing requirement.

As the object of clearing was to get sugar pine established, seedlings, saplings, and scattered poles of other species, and high brush were eliminated from the regeneration areas. For various reasons it was sometimes difficult for the dozer blade to push these plants out without also scooping up a large quantity of soil. The plants were left, and the swamper cut them with an axe. (A 2½-pound single-bitted axe was best for this job.) He also cut off some saplings knocked flat by the logging operations and other small trees and brush that resisted the dozer blade. Cleaning up the small trash on edges of piles and windrows was best done by hand and with the aid of a pitchfork.

To reduce fire hazards, all men engaged in the clearing operation coordinated their work so that no stringers of trash were left lying between slash piles and the reserve timber. This eliminated the danger of fire creeping to the live stands during the burning. Snag falling was done after clearing was completed. The fallers cut a firebreak section out of any snag that extended from a slash pile into the reserve timber. On his last inspection before the burning, the job supervisor carried a shovel to clear up any shattered wood from snags or other trashy fuel near slash piles.

Burning had to wait until the woods were wet because many large piles of slash had been accumulated. Most piles burned very hot for a few hours, and some carried a moderate amount of heat for several days; some piles smouldered over winter. An occasional inspection of the burning area was made during May, June, and July of the following season.

Costs

Records of time and costs were kept for the slash disposal and site preparation phases of the job for both 1948 and 1949 (table 1). The lower cost in 1949, $37.38 per acre cleared, contrasted with $58.55 per acre cleared in 1948, is largely the result of increased experience. A better clearing blade for the tractor and more experience in this type of work should reduce the cost even more. The cost of slash disposal and site preparation is presented in table 1 in three ways; (1) Per acre of regeneration area, (2) per acre of gross area logged during season, and (3) per thousand board feet, net landing scale, all timber cut. An operator's costs may be calculated from the man-day and hour-meter data given.

Table 1.- Time-cost table for slash disposal and site preparation

Item	Labor				Equipment				Total labor and equipment cost	
	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949
	Man days		Dollars		Hours		Dollars		Dollars	
Total	60	43.5	$824.15	$622.68	155	62	$1049.45	$349.10	$1873.60	$971.78
Per acre of regeneration area	1.88	1.67	25.75	23.45	4.84	2.38	32.80	13.43	58.55	37.38
Per acre, gross area logged	.67	.40	9.16	5.66	1.72	.56	11.66	3.17	20.82	8.83
Per M b.f. all timber cut	.017	.010	.232	.141	.044	.014	.295	.079	.526	.220

Notes: 1. Equipment use rates based on hour-meter readings: 43 hp. tractor - $2.75; 80 hp. tractor - $6.55; 130 hp. tractor - $7.45. Rates include charges for operation (fuel, grease, etc.), repairs, and depreciation. Hours of use: 1948--80 hp. tractor, 117; 130 hp. tractor, 38. 1949--43 hp. tractor, 15; 80 hp. tractor, 47.

2. Acres cut: regeneration--32 acres in 1948, 26 acres in 1949; gross--90 acres in 1948, 110 acres in 1949.

3. Net volume cut, Scribner: 1948, 3,559,140 board feet; 1949, 4,413,460 board feet.

4. Labor costs consist of straight wages for an 8-hour day; no allowances for leave and holiday pay. Labor of supervisory personnel included. Average wage for an 8-hour day: 1948, $13.74; 1949, $14.31.

Discussion

It is obvious that possibilities for clearing slash from regeneration areas have been only briefly investigated. New machines, tools, and methods should be tried. There are now on the market various types of land-clearing blades for attachment to tractors, most of them being arrangements of different kinds of teeth. Tests may show some of these blades to be satisfactory. If they all prove inadequate for the job, good ones should be designed. The ideal clearing blade should cut off live brush and small trees below ground level and move the slash to piles without picking up soil.

Whether or not the methods tried in slash disposal will result in site deterioration is a question which should be investigated. It must be remembered that a bare mineral soil is considered to be essential for establishing sugar pine reproduction by means of natural seedfall.

To date the effect of burned slash piles on restocking has not been thoroughly investigated. The information available[8/] shows no significant difference in survival of seedlings between areas where slash piles were burned and adjacent areas of bare soil.

In some localities it might be possible to sell limbs and chunks for firewood or other uses, either before or after slash is piled. Large accumulations of such material in regeneration areas, which are fairly accessible over skid trails, might make the recovery of firewood, shake, or post material an attractive enterprise for local residents.

Complete elimination of sprouting brush species does not result from the slash disposal methods described here. Some species, like whitethorn and chinquapin, sprout quickly. In an effort to control the sprouts as they appear, techniques of chemical spraying are being tested. But complete elimination of brush may not be necessary since slash disposal and site preparation are done only to give pine reproduction the initial competitive advantage it needs to keep ahead of brush growth.

Present experience indicates that the preparation of regeneration areas to receive seed or planting stock can be done at a reasonable cost, and at the same time provide fireproofing measures for the logging area.

8/ Fowells, H. A., and G. H. Schubert. 1951. Recent direct seeding trials in the pine region of California. California Forest and Range Experiment Station. Forest Research Note No. 78. 9 p. Berkeley, Calif.